MEMORANDUM

TO: Citizens Rate Advisory Committee
FROM: David Baylon
RE: Marginal Value of Energy and Production for Seattle City Light

DATE: March 27, 2004

Background

The use of the marginal value of energy is an historical phenomenon that has been included in ratemaking decisions at Seattle City Light for at least 20 years. It is important in this process to remember that the only necessary feature of the rate design is that the rates must recover revenue required to run the utility. This revenue requirement is based on the true average cost of all the energy, administration, and distribution system requirements to provide service. This rate design does not necessarily imply any particular criteria. The use of marginal cost pricing is done partly to allocate the demand of marginal use accurately across rate classes and partly to provide a block structure in which the highest consumption is priced at or near the true marginal cost.

To calculate the rate allocation, utility routinely does a cost-of-service analysis that is designed to assess the revenue requirements among the various customers, on the assumption that the cost of energy to the various customers is different. This strategy also assumes that the cost of producing and distributing energy varies with the size and the nature of the load each customer puts on the system.

For example, in the Seattle City Light service territory, the maximum capacity required by the utility’s resources occurs in the winter and is associated with a heating requirement. The sector most responsible for this increased in load is primarily residential. Of course, when the winter residential peak occurs, commercial and industrial buildings are also experiencing temperature-based loads but these sectors tend to have much less seasonal variation in consumption. The overall combination is attributed mostly to the residential sector. To the extent that the utility knows the cost to maintain capacity during these peak months, it is possible to assign a value to the extra cost that is incurred at the peak. That value then can be assigned to the residential sector, assuming this sector demands the extra capacity. In assigning the incremental cost associated with the residential sector, an accounting system is used to assign the value of this peak energy proportionally to that sector.

Average Cost vs. Marginal Cost

For the average value of energy, the calculation is based on the estimated actual cost of the energy from the various sources over the period covered by the rate calculation. For example, the average cost of generating the hydroelectricity from dams and buying various contracts from hydroelectric sources in the region has different pricing depending on time of year and time of day, but overall, the average cost of energy can be calculated for the utility and assigned in proportion to the amount of energy required during each billing period or during the whole year.

In calculating this, however, a certain amount of economic inefficiency is thought to occur. The majority of economists argue that fees charged on an average cost basis tend to give consumers the wrong signal. As the consumer demands the next increment of energy, average cost pricing leads to the assumption that the actual cost of that next increment is the average cost of all the power that has been used up to that point. The reality is that the utility first generates power from its least expensive resources (hydroelectric dams on the Skagit and Pend Oreille rivers), followed by its least expensive contract power from the mid-Columbia projects, and so on through the resource stack. The last increment of power sold to the consumer is, presumably, the most expensive to the utility. If a consumer is to decide whether or not to use that next increment of power, either to increase industrial production or to add a big screen television, the utility would like the consumer to correctly understand the impact of the increased energy use on its own cost to provide that power—that will be the most efficient use of resources (by definition).

Therefore, to be economically efficient, the utility would use a rate structure in which the marginal cost is seen by the consumer for some or all consumption. Since the marginal cost is noticeably higher than the average cost, this means that more revenue might be collected than was actually spent by the utility to procure the resource.

These principles have been a part of rate-making for the utility for at least 20 years. Up until about 1995, the marginal resource cost was noticeably higher than the average cost and much higher than the least expensive utility source. In the 1980s, the marginal resource was priced from power supplied by the Washington State Public Power Supply System (WPPSS) nuclear power plants which were predicted to produce energy at a cost that was then approximately 10 times the cost of Seattle City Light's least expensive source. The goal of rate design at that time was to try to limit the utility's exposure to these high cost resources.

In the more recent past the utility has added a twist to this process meant to reflect environmental and/or social costs not captured by the market price of the power purchased. These "costs" are called externalities and are added to resource costs to assess the value of these resources versa the full cost of the generation. The problem with externalities is that they are very difficult to quantify. If the utility thinks that a particular resource damages fish runs then it must figure out what that cost is per kWh generated. As a practical matter this accounting is very difficult and the current strategy is to quantify the emissions from the power plant that may have generated the market based power. The solution has been further simplified to count only CO_2 this has the advantage of several calculation that purport to assign an acceptable value to these emissions that can be assigned to a resource as part of the decision to purchase that resource.

Marginal Cost in SCL Rates

The historical mechanism for using marginal cost then is not to set rates but to constructing the utility's block structure within the individual customer classes. The situation proposed by the utility in 2003 is more complicated than the traditional marginal cost methodology. This is true for two reasons:

1. The current marginal cost is now the actual West Coast short term power market, which experiences the most price volatility of any source. As a result, calculating the actual cost of energy to the utility has reached the point of greater economic uncertainty than at any time in recent history. The ability of the utility's fairly sophisticated modeling program to predict the long term cost of energy is limited. This model is inadequate in the face of market perturbations such as the energy crisis in 2001, during which the short term cost of energy rose by a factor of 10. Following that perturbation, the price dropped again to roughly its previous level. No current pricing model could have predicted the combination of malfeasance, misfeasance, incompetence and weather that led to that condition. Nevertheless, in order to project the marginal cost as the market price, some model for relative supply is necessary. Given that the market is relatively stable under most circumstances, such a model is likely to produce an acceptable result.

2. The cost of energy from this market is not more expensive than the last resources in the utility's resource stack. In fact, some resources are almost twice as expensive. This difference is reduced (but not eliminated) by including environmental "externalities" in the calculation.

The utility adds externalities in accordance with agreements with the City Council. These costs are associated with operating gas turbines, coal-fired plants, etc. that cause environmental damage. The SCL calculation for these externalities amounts to approximately $0.015 to $0.02/kWh. This amount is intended to cover the cost of generating large amounts of carbon dioxide coming from coal- and gas-fired power plants to produce the power sold. It is important to realize that while the externalities are not actually a part of the cost of purchasing electricity (meaning Seattle City Light does not actually pay that extra $0.015/kWh), the goal is to describe a marginal cost that reflects the extra value the city places on reducing carbon emissions as part of the ratemaking policy. It is important to realize that this will not change the total amount of revenue at all, but it may change who pays for the consumption.

Marginal Cost vs Actual Resources

There are a few other aspects to the use of marginal pricing that should be mentioned. The utility's position is that the purchased resources from contracts such as the mid-Columbia projects, the Bonneville Power Administration (BPA), the Stateline Wind Project and the Klamath Falls gas turbines are part of the resource stack that will be purchased in any case. The utility asserts that the cost of these various resources do not reflect the marginal cost, even though in some cases they are actually more costly than the spot market price. At Klamath Falls, for example, the cost to generate electricity is approximately $0.065 (not including externalities), and it costs the utility about half of that to *not* generate that electricity. That is because the utility must pay a portion of the cost for capital, operating and maintenance for the plant even when no power is taken. When power is taken, the utility must pay an additional cost buy the gas to generate that power. This makes the total cost of generation from this source in the range of $0.055 to $0.08/kWh, depending on how much energy the utility takes.

To generate the marginal energy cost, the cost of actually owning a share of the Klamath Falls plant should not be considered part of the marginal energy cost or even average energy cost, but included with the administrative and distribution costs of the utility. In fact, the true measure of the market cost is the availability of surplus energy (and thus income) to offset the utility's rates.

One very interesting facet of the current situation is that the cost of energy from various other marginal of the sources available to Seattle City Light ranges from about $0.04/kWh for BPA hydroelectric power to about $0.06 for Stateline Wind. As you can see. All of the last few resources from BPA, Stateline Wind, and Klamath Falls are about the same price as the market price (read marginal cost) plus the externalities assigned.

In fact, the value of energy as it is set in the open market is not likely to be reflected in utility rates since it is not necessary for the utility, in most weather circumstances, to purchase energy from the spot market. If the utility runs Klamath Falls or Stateline wind as backup resources, but finds that it is unnecessary to use the resulting power, it can resell the extra on the open market. The market price is the actual value in the market of this risk management strategy (currently about $0.035 to $0.04 depending on load shape). The cost is then the difference between the cost of generating energy from these sources and the market price.

As of this writing, I was not able to determine specific values (projected or otherwise) for the various contracts that contribute to the utility's average energy cost and energy acquisition costs. This is unfortunate, because I believe that the marginal cost as it is calculated is not the most important variable in deciding on a rate structure. Even if it is, the relative importance of this calculation may be reduced dramatically because it resembles other ways that the marginal cost might be calculated, such as the most expensive supply increment.

If the market price is to be used as the basis for marginal cost calculations, then a different calculation should be used that takes into account the risk management strategy practiced by the utility. This is because that policy causes the utility to maintain supply resources that would meet the utility's needs should under most weather conditions without resorting to market purchases. The cost of this strategy is actually higher than the cost of purchasing power on the open market, at least at this time. The incremental cost of this management strategy should be taken into account as the basis of the last increment of the supply.

I am sympathetic to the use of marginal cost pricing, particularly in environments where rising marginal costs are a feature of the cost structure. Given the conditions presented here, it does not appear that the proposed calculation reflects current market conditions. If the market is the marginal source, then the cost of the resources two years ago are the most expensive, and current prices have actually fallen dramatically. Thus, only through the use of externalities can the marginal value of energy appear even close to the actual incremental cost of risk management or incremental purchased energy. In these circumstances, I would suggest that rate making around the more expensive contracted sources might be more productive. A reasonable alternative would be to use the average of the most expensive 25-30% of the resource stack. Either of these approaches would provide a better basis for assessing the impact of growth on individual sectors and on total usage.